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A Summary of Current Program, 7/1/62;

and Preliminary Report of Progress

for 7/1/60 to 6/30/62

STANDARDS AND RESEARCH DIVISION

of the

STATISTICAL REPORTING SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

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This progress report of U.S.D.A. and cooperative research is primarily a tool for use of scientists and administrators in program coordination, development and evaluation; and for use of advisory committees in program review and development of recommendations for future research programs.

There is included under each problem area in the report a brief and very general statement on the nature of the research being conducted by the State Agricultural Experiment Stations and the professional manpower being devoted by the State stations to such research. Also included is a brief description of related work conducted by private organizations. No details on progress of State station or industry research are included except as such work is cooperative with U.S.D.A.

The summaries of progress on U.S.D.A. and cooperative research include some tentative results that have not been tested sufficiently to justify general release. Such findings, when adequately confirmed will be released promptly through established channels. Because of this, the report is not intended for publication and should not be referred to in literature citations. Copies are distributed only to members of Department staff, advisory committee members and others having a special interest in the development of public agricultural research programs.

This report also includes a list of publications reporting results of U.S.D.A. and cooperative research issued between July 1, 1960 and June 30, 1962. Current agricultural research findings are also published in the U.S.D.A. publications, Agricultural Economics Research and Farm Index. This progress report was compiled in the Standards and Research Division, Statistical Reporting Service, U. S. Department of Agriculture, Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D. C.
July 1, 1962

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INTRODUCTION

In the Statistical Reporting Service there are three divisions: Agricultural Estimates, Field Operations, and Standards and Research. Agricultural Estimates Division is located in Washington, D. C. It administers crop and livestock estimating programs designed to provide current information about crop acreages and production, livestock numbers, and other statistics pertaining to the agricultural economy. Field Operations Division has its headquarters in Washington, D. C., but it administers the field operational activities of the crop and livestock estimating and reporting programs through the medium of 43 field offices which serve the 50 States. Standards and Research Division, also located in Washington, D. C., administers programs which include statistical clearance, research in sampling and survey methods as applied to the data collection activities of SRS, development of techniques of statistical measurement equitable to substantive research, research on reasons for preference and behavior affecting consumers' purchases and use of agricultural products, quality discrimination studies among consumers, program evaluation studies, and surveys relating to the marketing of agricultural products. This Division also performs data processing services using electronic and electro-mechanical equipment. The research activities of SRS are conducted by the Special Surveys and the Research and Development Branches of Standards and Research Division, and both perform service as well as research activities.

In the past few years, the following reports dealing with consumers' opinions of natural fibers in various end uses have been published by the Special Surveys Branch: "Manufacturers' Opinions of Cotton and Leather Used in Shoes," "Homemakers Appraise Cotton, Wool, and other Fibers in Household Furnishings," "Men's Preferences for Cotton, Wool, and other Fibers in Selected Clothing Items," "Mothers' Opinions of Fibers in Children's Clothes," and "Women's Attitudes toward Cotton and other Fibers in Clothing."

Results of these and similar studies have been used by natural fiber organizations to evaluate the position of cotton and wool in specific segments of the textile industry, and to encourage and guide private industry's efforts to improve the attributes of natural fibers so that they can compete more successfully with synthetics. In addition, each year the National Cotton Council of America bases a major portion of its promotion program for consumers and retailers on these research results; they have also used these reports as standard examples in the market development program of Cotton Council International.

In the past few years, publications have also been released on a number of studies conducted in cooperation with other agencies to evaluate the market potential of new or improved products developed

by the USDA's Utilization Research Regional Laboratories. One such study was concerned with consumer reaction to a canned cooked rice product. Results indicated a definite need for certain improvements in the product before commercial production would be feasible, thereby preventing an uneconomic allocation of funds to a processed product which would have been rejected by consumers and would therefore have resulted in a loss to the producer.

Another survey undertaken to measure consumer reaction to instant potato flakes indicated that the product had considerable appeal to consumers and could be successfully marketed if proper promotional and merchandizing efforts were employed. As a result of this research, a number of companies are now producing flakes for commercial use; the product has proved successful and is now sold throughout the country. The importance of this project was also recognized in another manner; it received an award from the Washington chapter of the American Marketing Association as an outstanding contribution to the field of agricultural research.

Surveys were conducted at the request of the Food Distribution Division of AMS to evaluate the Pilot Food Stamp Program in two areas from the standpoint of coupon users, the general public, welfare workers, and retail grocery operators. As a result of preliminary data from these surveys on reactions to the Pilot program, the Food Distribution Division introduced a number of changes in planning the expansion of the Food Stamp Program.

The improved survey methods developed by the program of research conducted by the Research and Development Branch are being put into operation by SRS as rapidly as resources will permit. In June and December of 1961, full-scale enumerative surveys were conducted in 16 States as were objective yield surveys for corn and cotton. The number of States was increased to 20 in 1962, and an objective wheat yield survey designed to produce regional estimates was added. The research program which produced the methodology for these surveys is coming into fruition as planned through their incorporation into the operating program of SRS.

AREA NO. 1: CONSUMER PREFERENCE AND QUALITY DISCRIMINATION--
HOUSEHOLD AND INDUSTRIAL

Problem. With the increasing complexity of marketing channels and methods, it has become almost impossible for the consumer to express to producers either his pleasure or displeasure with available merchandise. In order to market agricultural products more efficiently, we need to understand existing household, institutional, and industrial markets and the reasons behind consumers' decisions to purchase or not to purchase. Information is needed on preferences, levels of information or misinformation, and satisfactions or dislikes of both present and potential consumers. We also need to know consumer attitudes toward the old and new product forms of agricultural commodities and their competitors, and probable trends in the consumption of farm products. We need to know the relationship between agricultural and nonagricultural products and the relationship of one agricultural commodity to another in consumers' patterns of use. Producer and industry groups and marketing agencies consider this information essential in planning programs to maintain and expand markets for agricultural commodities which, in turn, increase returns to growers.

USDA PROGRAM

The Special Surveys Branch of the Standards and Research Division conducts applied research on representative samples of industrial, institutional, or household consumers and potential consumers, in local, regional, or national marketing areas. Such research may be conducted to determine: attitudes, preferences, buying practices, and use habits with respect to various agricultural commodities and their specific attributes; the role of competitive products, and acceptance of new or improved products.

The Special Surveys Branch also conducts laboratory and field experiments in sensory discrimination of different qualities of a product. These studies ordinarily relate discrimination to preferences and attitudes as they influence purchases in order to assess the standards of quality, packaging, etc., which are needed to satisfy consumer demands.

In addition to surveys of consumer preferences and discrimination, the Special Surveys Branch also provides consultants and conducts special studies, upon request, for other agencies within the Department of Agriculture or within the Federal Government, when survey methods can be usefully applied to the evaluation of programs, services, or regulatory procedures of interest to the requesting agencies.

The work of the Branch is carried out in cooperation with other Federal governmental agencies, divisions within the Department of Agriculture, State Experiment Stations, Departments of Agriculture, and land grant colleges, agricultural producer, processor, and distributor groups. Closely supervised contracts with private research firms are used for nationwide surveys; studies in selected areas are usually conducted by the Washington staff, with the assistance of locally recruited personnel.

The Branch maintains all of its research scientists, who are trained in social psychology and other social sciences, in Washington, D.C., which is headquarters for all of the survey work whether it is conducted under contract or directly by the Branch.

The Federal scientific effort devoted to research in this area during the past year totaled 7.0 professional man-years under regular program funds; of this total, 6.8 professional man-years were devoted to consumer preference research and .2 professional man-years were devoted to quality discrimination research. An additional 2.2 professional man-years were devoted to research conducted under transfer of funds arrangements.

RELATED PROGRAMS OF STATE EXPERIMENT STATIONS AND INDUSTRY

State Agricultural Experiment Stations. The Stations do not report any of their work under this heading. However, they do have a considerable program in the area of consumer buying and use practices and motivation and decision making. This includes some research in preference and quality discrimination. There is a reference to parts of the stations' program in other division reports.

Industry and Other Organizations conduct research in this area, but the research done by individual firms and organizations is almost without exception for their exclusive internal use. There are very few instances in which the findings are made public or made available for government reference. In addition to the research actually initiated and paid for directly by industry, a substantial amount is undertaken in their behalf as part of the service provided by their advertising agencies.

Producer Groups: A number of food producer groups conduct consumer preference work with their own staff and, in addition, contract for research with private marketing firms. To a large extent, this research is limited to food classes such as poultry, dairy products, citrus and deciduous fruits (rather than being directed to individual branded products). This research ranges from a small to national coverage. It includes taste testing for quality differentiation, new product acceptance, and attitudes toward existing products. The producers of agricultural fibers have a small but active research program on quality evaluation and consumer preferences, both household and

industrial, for cotton and for wool. Estimated annual expenditures by these groups are equivalent to approximately 10 professional man-years.

Food Processors: In the livestock industry most of the larger packers have research programs for evaluating the effect of product change and acceptance of new meat products. A sizable number of other food processors have extremely large programs of consumer research. They are engaged in work on new food forms and convenience foods such as cake mixes, canned and frozen fruits and vegetables, deciduous fruits, citrus fruits, soups, dairy products, and alcoholic beverages. Manufacturers of cooking oils and shortenings support sizable consumer research programs with their own staff and also under contract. Manufacturers of dehydrated foods, such as potatoes, are constantly engaged in consumer research on their own and on competitors' products. Estimated annual expenditures are equivalent to approximately 400 man-years.

Processors of Nonfood Products: Large programs are supported by all of the major chemical manufacturers, directed to consumer preference and acceptance of synthetic fibers and blends. The three largest textile mills which represent a major proportion of the fabrics manufactured in the United States support research of this type. All of the large manufacturers of cigarettes do research to find out consumer taste preferences for their product; what blends, filters and packages are most likely to succeed in catching and holding a market. Estimated annual expenditures are equivalent to approximately 250 man-years.

Miscellaneous Groups: There is a smaller but constant amount of research undertaken by magazines and publishing houses for their principal advertisers. A number of the largest retail stores in our major cities study the consumers' reactions to their merchandise and service by conducting interview studies with customers and noncustomers. One of the largest food retailing chains has an active program in quality research which involves taste testing as well as consumer preference. Estimated annual expenditures for research related to agricultural commodities and nonagricultural products in competition with them are equivalent to approximately 20 professional man-years.

REPORT OF PROGRESS FOR USDA AND COOPERATIVE PROGRAMS

A. Consumer Preference

1. Fiber criteria stability. A study conducted in cooperation with the Pennsylvania State University among a sample of homemakers in York, Pennsylvania, has been completed. A report covering the relative importance of certain fiber characteristics in selecting dresses - the first phase of the study - was released in 1959, and has been discussed in previous progress reports.

The second phase of this study was designed to determine the stability, over time, of the respondent's opinions of the importance assigned each fiber characteristic when selecting dresses. In order to assess the stability of the ratings of importance given each fiber characteristic, repeat interviews were made with the original sample of homemakers over a period of several years. The results indicate that there was a high degree of consistency in the individual's rating of a characteristic over repeated interviews, and when individual ratings were averaged there was a notable degree of stability of mean scores over the entire study period. A report covering this phase of the inquiry will be published by Pennsylvania State University. (MD 1-13)

2. Fibers in women's clothes. Final results were published of a nationwide survey of women, conducted under contract, to determine their preferences and reasons for their preferences for fibers in summer skirts, summer suits and dresses, between season dresses, knit dresses, slips and half-slips, summer and winter blouses, and rainwear.

Cotton was the most popular material for the summer apparel studied, and rated well for the garments worn in other seasons of the year. Nylon dominated the picture for both whole and half-slips; wool was the favorite for knit dresses. While appearance and style were leading factors in the selection of a particular garment, ease of care and laundering were the major factors given for preferring a particular fabric for most garments. In appraisals of the general qualities of selected natural and manmade fibers or blends, cotton received more favorable mentions for general qualities such as appearance, comfort, durability, ease of sewing or mending, versatility, and ease of laundering. Comments regarding the newer man-made fibers centered around the wash-and-wear features. Nylon and rayon were the only fibers vigorously criticized. The objections to nylon were chiefly discomfort such as excessive warmth and lack of absorbency, and the effects of static electricity, and lack of durability. Rayon was commented on adversely mainly because of lack of durability and difficulties in care and laundering. (MD 1-34)

3. Fibers in automobiles. Data collection has been completed for a study conducted under contract to determine volume use and preferences among automobile manufacturers for fibers and fabrics in automobile interiors and convertible tops. This study, as a follow-up of comparable studies in 1950 and 1955, is to provide the natural fibers industries with information on changes in the kind and volume of fibers used since 1955, and the reasons for such changes. Preliminary results indicate that the volume of cotton used in autos declined from 1955 to 1961, along with a decline in volume for most of the other materials used, mainly because fewer cars were produced

in 1961. Cotton's share of this market remained about the same, but there were significant shifts in the pattern of use. The proportion of cotton used in seat padding increased, while the proportion used in sidewalls and headlinings sharply decreased. The increased use of paper and vinyls accounted for cotton's displacement in these latter areas.

The preliminary report on volume use of various fibers and fabrics will be released late in 1962. A final report, incorporating both volume data and information on preferences and needs, is being prepared for publication in 1963. (MD 1-49)

4. Fibers in young people's clothes. A contract has been signed for a nationwide survey of the opinions, attitudes, and preferences of teenage boys and girls about cotton, wool, and manmade fibers in selected items of clothing. The purpose of this study is to provide the cotton and wool industries with information on changing attitudes toward and preferences for various fibers so that these industries can direct their laboratory research and public information efforts more sharply toward strengthening their position with these consuming groups. Planning on this study is complete. Additional work on the study has been delayed by the contractor's loss of key staff and other difficulties. It is hoped that a satisfactory solution to the contractor's problems will be worked out so that field work can be undertaken in 1963. (MD 1-47)

5. Citrus. About one-third of the Florida oranges marketed for fresh consumption are sold in their natural-color state, principally in eastern states. Midwestern states receive primarily color added fruit. In order to test the acceptance of natural color fruits, three-phase surveys were done in one midwestern and one eastern city, in cooperation with Economic Research Service, measuring opinions of and attitudes toward natural versus color added fruit. Nearly three-fourths of the orange purchasers interviewed at side-by-side displays of color added and natural fruit knew of the practice of color addition. Nearly half said that it made no difference to them, the remaining purchasers being divided on whether it was a desirable or undesirable practice. The majority, however, indicated that they would have purchased oranges whether or not color had been added, suggesting that, while some buyers disapprove of the practice of adding color to oranges, their attitude is tempered by the belief that the color does not effect the eating quality of the fruit. This study of citrus fruit has been completed and a report published. (MD 1-43)

6. Citrus juice. To aid Florida citrus processors in determining the most desirable sugar-acid levels in packs of canned single-strength citrus juice for export and in understanding attitudes of European

consumers toward use of citrus products, a consultant was made available by the Special Surveys Branch to set up an experiment in taste testing and a household survey in West Germany.

7. Wheat. Per capita declines in the human consumption of wheat have led to a search for new markets and new forms in an effort to expand consumption. A new canned form of cooked whole wheat developed by U. S. Department of Agriculture's Western Utilization Research Laboratory was introduced in a market test in Wichita, Kansas in 1961. Two varieties were offered, a plain cooked wheat, and one flavored with chicken. Results of the market test, which was conducted in cooperation with Economic Research Service and the Kansas Wheat Commission, indicated that the test product could compete favorably with various prepared items such as canned or dry rice or spaghetti dinners. About 18 percent of the households in the study area had purchased the test product by the end of the two-month market test period. Although users appeared well satisfied with the product, a followup, made two months after the end of the original survey, indicated that the level of purchases during the two-month period had declined to about 9 percent of the households, of whom about half were repeat purchasers from the original survey. A related survey of restaurant use of the test product indicated that about one-sixth of the area restaurants had used it. Its use was confined primarily to the larger restaurants or cafeterias. While the number of establishments reporting use was too small to permit detailed evaluation, there appeared to be general satisfaction with the test product especially when used as a filler or meat extender. A report on this work is being prepared for publication. (MD 1-46).

8. Sweetpotatoes. Seasonal variation in the price of sweetpotatoes and marked variations in the size and shape of the sweetpotatoes themselves, which prevents a substantial portion of each crop from meeting the grading standards necessary for human consumption, have led sweetpotato producers to search for new processed forms in which to market their crops. A new form of canned, cooked, dehydrated "instant" sweetpotatoes, developed by the Southern Utilization Research Laboratory, was recently tested for consumer acceptance among a representative sample of households in the Alexandria, Virginia area. Homemakers were interviewed on their present use of sweetpotatoes and their reactions to samples of the test product as they used it in several different recipes. The results of this study are expected to indicate what changes, if any, are desirable in the product itself or the packaging and recipes, and whether or not additional tests in a competitive marketing situation would be helpful in evaluating the product's appeal to consumers. (MD 1-51)

9. Apple juice. A final report is being prepared for publication on a study to determine consumer acceptance, on a commercial trial basis, of a superconcentrated apple juice developed by the Eastern Utilization Research Laboratory. Results of the market test conducted in

Ft. Wayne, Indiana, in cooperation with the Economic Research Service and the Michigan State Apple Commission, indicated that about 11 percent of the households in the area purchased the test product during the period of study. Most of the purchasers were new to the use of apple juice. Both the favorable reactions of users and reported interest in future purchases suggested that the test product might well achieve a favorable reception in competitive markets. (MD 1-45)

10. Noncitrus fruit. A contract was recently signed with a private research firm to conduct a study on selected noncitrus fruits such as apples and peaches. Substantial shifts have occurred in the past two decades toward the use of processed as opposed to the use of fresh fruits. Interviews with a nationwide probability sample of homemakers will ascertain the present pattern and frequency of use of selected noncitrus fruits, and the attitudes and opinions which influence use or nonuse. (MD 1-52)

11. Poultry. Available information on consumer use of and attitudes toward poultry on a nationwide basis is seriously out of date. Since the last national study on this subject, conducted by the Department of Agriculture in 1956, the production of broilers has greatly increased while prices to producers have decreased. Planning was therefore recently begun on a proposed new survey to be conducted under contract to provide poultry producers current information on consumer preferences, usage, and buying practices.

12. Family food habits. A study of the effect of differences in national background, education, and occupational status of families on their food habits, done in cooperation with the Pennsylvania State University, was completed and a report has been issued by the University. This study was undertaken to ascertain the effect of ethnic and social characteristics of the family on the relative use of meats, dairy products, and certain fruits and vegetables. National background was found to determine to some extent the kinds and amounts of meats used, although this influence appeared to decline among younger families. Families of American background were more likely to include fruits and fruit juices in their menus than were families of foreign background. Increased education and occupational status resulted in the increased use of fruits, fruit juices, non-leafy green vegetables, and cheese and ice cream, but not in the increased use of whole milk or meats and poultry. (MD 1-23)

13. School lunches. A study was conducted to provide information for the Food Distribution Division, AMS, on the food consumption patterns of teenagers and on their opinions and attitudes regarding participation or nonparticipation in the National School Lunch Program. Earlier surveys had indicated that less than half of the nation's elementary and secondary school children were availing themselves of the School Lunch Program when it was offered in their

schools. The present study was conducted among a representative sample of high school children in one northeastern city. It was found that the most popular lunches were those eaten at home and those purchased outside the school. In actual practice, however, the most usual lunch was that carried from home. The students liked this type of lunch because it provided the chance to get the foods they liked best, and they considered it a convenient and economical way of having lunch. Whether to bring lunch from home or buy it appeared to be decided by the students; only about one-fifth said their parents made the decision. (MD 1-41).

14. Food stamp plan. The Special Surveys Branch participated in an evaluation of the pilot food stamp program at the request of the Food Distribution Division, AMS, which financed the research. Surveys were conducted in two of the eight pilot areas to determine attitudes about, and reactions to, the food stamp program. Groups interviewed were a cross section of low-income families who were, and also those who were not, participating in the program, moderate and higher-income families in the community, food retailers, and welfare workers. Results indicate general satisfaction with the program on the part of all groups. Retail grocers reported their sales increased. Participating families reported an increase in the amount and quality of the food that they consumed, especially in such products as meat, poultry, milk, eggs, and fresh fruits and vegetables. Welfare workers in the study areas were, in the main, satisfied that the program was doing a better job than existing or prior programs in improving the diet of low-income and needy families. Finally, the results indicated that families of moderate and higher incomes, although not themselves eligible for the program, had received the program with the recognition that low-income families should be enabled to obtain more and better food, and generally approved of the food coupon approach.

Preliminary results of these attitude surveys were included in a report on the food stamp plan which was issued by Agricultural Marketing Service early in 1962. A final report to Agricultural Marketing Service is in preparation. (MD 1-48).

15. Duration of household food supplies. At the request of the Office of Civil Defense and Defense Mobilization of the Department of Defense, a nationwide survey financed by that office is presently underway to ascertain homemakers' estimates of the number of days of food supplies on hand in their households at a given time. The Bureau of the Census has undertaken the field interviewing and tabulation. The Special Surveys Branch developed the questionnaire, and will present an analysis of the results of the survey to the Department of Defense for their use in the overall evaluation of the civilian food supply problem in the event of enemy attack. (S&R-O-O-1-DOD).

B. Quality Discrimination

1. Frozen french-fried potatoes. A report has been published on an experiment conducted under contract to determine whether or not household consumers could discriminate among four different packs of frozen french-fried potatoes containing variable amounts of slivers, small, and irregular pieces; and if they could discriminate, whether or not they had any preferences regarding uniformity of quality. This study was conducted at the request of the Fruit and Vegetable Division of the Agricultural Marketing Service to aid in the development of standards for grades. A cross-section sample of households in Pittsburgh, Pa., tested the four packs, one per week, through four weeks. Results of the experiment indicate that homemakers tended to rate a pack higher and to prefer it more as it became more uniform in size and composition, and that it is probably somewhere between the 15- and 30- percent levels that the proportion of slivers, small pieces, and irregular pieces may become objectionable to consumers. (MD 1-44).

2. Citrus. Planning was begun on a study on citrus fruit to be conducted in one city to determine what external characteristics consumers actually consider desirable and undesirable when they are purchasing fresh oranges or grapefruit. This information will be compared with the opinions of producers and wholesalers about what consumers want and look for when they are purchasing fresh citrus fruit. One of the long-standing problems of fruit producers has been that they receive lower prices for fruit which wholesalers believe has defects that are objectionable to retail consumers. To what extent these beliefs are founded on fact is the subject of this inquiry. (MD 1-50).

PUBLICATIONS REPORTING RESULTS OF USDA AND COOPERATIVE RESEARCH

Consumer Preference

- Weidenhamer, M. H. 1961. Women's attitudes toward cotton and other fibers in clothing. Marketing Research Report No. 493 (MD 1-34).
- Fliegel, F. C. 1961. Food habits and national backgrounds. Bulletin No. 684, Pennsylvania State College of Agriculture (MD 1-23).
- Havas, N., Linstrom, H. R., et. al., 1962. Consumer acceptance of Florida oranges with and without color added. Marketing Research Report No. 537 (MD 1-43).
- Umstott, H. D. 1961. Preliminary results of a market test of bulgur (redi-wheat). Paper presented to a meeting of the Kansas Wheat Commission, September 1961 (MD 1-46).
- Food Distribution Division, AMS, USDA. 1962. The food stamp program: An initial evaluation of the program. Bulletin AMS-472 (MD 1-48).

Quality Discrimination

- Linstrom, H. R. 1961. Frozen french-fried potatoes--effect of size of pieces on consumer preferences. Marketing Research Report No. 514 (MD 1-44).

AREA NO. 2: IMPROVEMENT OF CROP AND
LIVESTOCK ESTIMATING PROCEDURES

Problem. The Statistical Reporting Service produces a large number of current statistics pertaining to agriculture. Because of limited resources, statistical methods were devised with a view to producing the most information for the least cost. These methods are subjective in nature and are based largely upon self-selected samples from voluntary crop reporters, who fill out and return mailed questionnaires. The information is generally collected in the form of relatives such as acres this year compared to last, and crop condition as a percentage of full crop. Persistent bias is removed by charting and census or other check data are generally projected to form current estimates. Estimates based on these sample methods have proved relatively satisfactory over the years. However, in seasons when changes are unusually large the changes may not be fully reflected in the appraisals and reports of the respondents to mailed questionnaires. In situations like this, when accuracy is needed most, the estimates may lack the required precision. Then, when the estimates are translated into available supplies for the different commodities, price inequities may occur and, as a result, producers or the processors of agricultural commodities may suffer serious financial loss.

With the development of modern statistics, new methods based upon probability sampling have been developed. Although surveys based upon probability sampling are more expensive to conduct than the traditional self-selecting mailed survey, these new methods offer a means of increasing the precision and reliability of the estimates. A properly designed well-conducted sample survey can produce unbiased estimates which have the desired levels of precision and reliability. Because of the need by the agricultural economy for high quality statistics, it is mandatory that the statistical theory and methods be developed and adapted to the needs of SRS. Some of the new procedures have already been introduced but there is an urgent need for a continuing research to devise efficient survey methods so as to make possible continuing improvement in the quality of SRS statistics.

USDA PROGRAM

The Department conducts a program of applied research designed to strengthen and improve the methodology used in collecting agricultural statistics. The principal disciplines involved are mathematics, statistics and probability, but other disciplines

relating to a particular problem are brought to bear as required. Examples of these are plant physiology, psychology, cartography and photogrammetry. The current program consists of 5.0 professional man-years per year devoted to the study of sample and survey methods and 4.0 professional man-years working on methods for forecasting and estimating the yields of important crops. Work under this program is done in Washington, D. C., and in SRS field offices located in the States concerned.

Research objectives in survey methods are concerned with the improvement of all aspects of survey design. These include questionnaire and form design, universe definition and sampling frame construction, sample design and estimators, enumeration techniques, quality checks, editing procedures, methods of processing data and the post-analysis of the survey with a view to improvement of design. In the current program priority is being given to the construction of an area sampling frame for 11 Western States; to the investigation of sources of lists, their maintenance and optimum use as sampling frames for probability sampling; and to the problem of developing methodology for collecting data by mail and enumeration in the same sample survey using lists in conjunction with area as frames. A preliminary exploration of the possibility of using aerial photography in estimating acreages of crops and numbers of livestock is getting underway. In this area, problems requiring study are those of sample design and photo interpretation as well as the use of this technique to supplement a general-purpose survey. Response errors are being studied by North Carolina State College under a cooperative agreement as well as by statisticians in SRS. Here the objective is to establish communication with the respondent through the medium of a questionnaire which will transmit concepts with a high degree of fidelity and at the same time induce the respondent to reply and to reply honestly and fully. An attempt is being made to distinguish between those items for which the respondent has accurate knowledge, those items which he may have once known but no longer recalls accurately, those items which he had never known precisely, and those items for which he is unwilling to divulge information or gives deliberately misleading information. Where applicable, alternative sources of information will be sought and different ways of motivating respondent cooperation will be tested. Work on objective yields is being continued. This includes the refinement of the forecasting models being tested as well as the development of forecasting procedures for other important crops. Corn, cotton, wheat and soybean models are being refined by computing parameters based upon larger samples and by broadening the range of plant maturity recognized by the model. Among the other crops for which objective forecasting procedures are being developed are grapes, onions, sour cherries, sorghum and pasture grasses. The studies

on forecasting sorghum yields and the production of pasture grasses are being conducted under a cooperative agreement with Iowa State University in Ames, Iowa.

Work on forecasting yields of peanuts and Maryland tobacco was terminated during the year. The stratum delineation work in 11 Western States was virtually completed, and these materials are in process of being assembled into an area sampling frame for those States.

RELATED PROGRAMS OF STATE EXPERIMENT STATIONS AND INDUSTRY

Because of the orientation and specialized nature of research in this area, research activities outside the government are limited. The Florida Experiment Station is devoting about one professional man-year per year to developing improved procedures for estimating vegetable crops and citrus production. However, this research is in collaboration with the Florida office of SRS and is, in effect, an extension of the Department's program into areas of special interest to Florida. A number of industries serving agriculture collect information for their use, but this is usually based upon field men's observations and there is no program of related research being conducted. A number of State agencies and a few industry groups cooperate with the Department by supplementing Department resources in order to extend scope or frequency of reports so there is little need for research in crop and livestock estimating methods outside the Department which is independent of the Department's program.

REPORT OF PROGRESS FOR USDA AND COOPERATIVE PROGRAMS

A. Objective Measurement of Yields

1. Sorghum and pasture grasses. Methods of measuring and forecasting yield and production sorghum and pasture are being studied by Iowa State University located at Ames, Iowa. Relationships have been discovered which can be used to predict the number of sorghum heads, but more work is needed on the forecasting of weight of grain per head. The small-scale study of pasture grass has developed crude techniques for making sample estimates of the weight of grass produced by placing cages in the pasture and clipping and weighing (wet and dry) the grass growing inside these cages. Considerable work is needed to determine the number and size of the cages and the time intervals between clippings since growth rates may be affected. (ES/A-2, Rev.)

2. Corn. Yield studies were conducted during the 1961 crop season in plots in about 440 fields in Michigan, South Dakota and Virginia. Forecasting procedures are being developed for these

States similar to those growing out of earlier studies completed in other States. Considerable progress was made in sharpening up certain of the definitions involved in the concept of an "ear of corn." Shortly after ears have been silked and before they have reached their maximum size, there has been inconsistencies in the way field samplers have defined ears of corn with grain. For counting purposes, modification was made in the criteria for classifying ears for the 1962 surveys. To date the counts indicate that this change has improved the results when compared to other survey counts. Work in refining the model for forecasting weight of grain per ear has continued. The parameters used in the models have shown continued improvement as more experience is gained in different crop years and under different crop conditions. Additional precision is also being obtained in an alternative grain weight per ear model through the data available from the sample ears submitted to a central laboratory. The dry weight of immature grain, used in conjunction with moisture content to determine the stage of development, has provided a means of forecasting grain weight under condition of substantial year-to-year change. Studies to indicate the potential damage from frost which are based on maturity considerations on August 1 and September 1 are being continued in connection with the laboratory phase of the work. These studies indicate the extent of the acreage affected and to a somewhat less extent the degree of damage in terms of the grain weight loss. Computer programs have been written which convert pilot surveys into forecasts of yield and which perform analyses needed for refining relationships in the forecasting procedure. Greater use has also been made of information on the fields remaining for harvest to determine acreage to be harvested. (ES/A-9, Rev.)

3. Winter wheat. These studies were conducted in nine States over the Winter Wheat Belt in approximately 950 fields during the 1962 crop season. Some improvements have been made in the early-season forecasting model, but additional refinements are needed to provide the desired accuracy. For the June 1 forecast, relationships involving the number of dead tillers require modification to be satisfactory for seasons in which the crop matures very early. Progress was made in formulating a second estimator to be used in forecasting the number of heads to be harvested. Improvements in the forecasting of final grain weight per head have been obtained using a spikelet count made by field samplers by graduating these field counts by counts made in a central laboratory. The number of spikelets present on very young heads is a good indicator of the final head weight at harvest. Computer programs for preparing the forecasts have been written and a pre-harvest estimate of yield for the nine-State region was made available to the Crop Reporting Board. During 1962 procedures were developed for using the survey

data to estimate acreages remaining for harvest. Laboratory procedures were simplified by more efficient use of sampling techniques. (ES/A-10, Rev.)

4. Soybeans. The soybean objective yield studies were continued in 11 North Central States and Arkansas in 1961 in 375 sample fields. Difficulties were encountered with the model being used to forecast pods. The 1961 crop season was the latest in which data from pilot survey was available. The experimental forecast of pod numbers provided on August 1 by the model currently being tested seriously underestimated the pods at harvest. Additional study is indicated to develop more flexibility and responsiveness to extreme conditions. Modifications made previously in the forecasting model for the September 1 forecast seem to be working fairly satisfactorily for the group of States as a whole, but parameters are needed for individual States. Part of the difficulty with pod number relationships may be caused by "drilled" fields. Plant spacing in these fields is quite different from fields planted in rows and sampling fluctuations may obscure or upset relationships. In Arkansas, the crop is so much later than in the North Central States that the present early-season forecasting procedure based upon pod counts are not satisfactory. Studies to develop a somewhat different type of model are underway. Modification of field procedures has resulted in making fewer counts on the plants in the sample plots and making somewhat more detailed counts on a few plants. These changes in field procedures appear to have reduced counting errors and this should in turn help stabilize relationships. (ES/A-11, Rev.)

5. Sour cherries. During 1961, objective sampling of cherries was continued in 135 orchards in Michigan. The number of sample orchards in the pilot surveys was such that more reliable estimates of sampling variation and studies by several maturity categories could be made with the data collected. The analysis of weight per cherry by maturity groupings based on days since bloom indicates a definite relationship. Additional studies will be made using the classification of trees into groups based on days after bloom to develop growth curves suitable for each group. A second phase of the cherry project was concerned with more frequent visits to a group of six orchards to make it possible to obtain more detailed information on growth and droppage. Visits were made every three days when the droppage and weight was changing rapidly. Observations of bloom, leaf development and hardening of pit were also obtained to provide a basis for a more precise determination of the droppage and weight curves.

In 1962, the Great Lakes Cherry Producers Association contributed funds for starting the development of a forecasting procedure which

would extend the Michigan forecasts to the important producing States in the Great Lakes area. Small pilot studies were initiated in Wisconsin, Pennsylvania and New York. As was expected, techniques for estimating fruit numbers that were developed in Michigan appeared to work satisfactorily in field tests in these three States. However, significant differences are expected in the droppage and weight parameters and perhaps in the rate of fruit development but the analysis of the data has not been completed. (ES/A-14, Rev.)

6. Irrigated cotton. Cotton grown under irrigation in California, New Mexico and Arizona has a radically different growth pattern from Southern cotton. Western cotton has a much longer growing season during which it sets a much larger number of bolls. Although a satisfactory model for Southern cotton is in operation, the same relationships do not hold for the Western varieties. Research surveys in 110 fields in the three Western States were conducted in 1961. As a result of this survey, additional information was obtained about the survival of young fruit. The survival rate appears to depend largely upon the maturity in terms of the stage of development of the crop. When the ratio of the mature fruit present to total fruit was used as an index of maturity, a relationship good enough for forecasting purposes appeared to exist between maturity and survival rate. This relationship will be tested in other yield surveys. Relationships for forecasting average boll weight from the weights of early maturing bolls were developed, but these relationships do not become stable until about 25 percent of the crop has been harvested.

Field procedures for obtaining fruit counts were modified in order to eliminate a possible bias in the previous method. Preliminary analysis indicates that the changes in counting methods were effective. (ES/A-16)

B. Survey Methods

1. Response errors. A project being carried out at North Carolina State is concerned with a study of response errors in interview surveys. The work to date has been comprised of three lines of investigation:

- (1) A study of literature concerning response error, its components, and possible contributing processes.
- (2) Observation of 161 interviews during the field work on the June 1962 Enumerative Survey in North Carolina.

- (3) A re-interview of 10 farmers from the 161 who had been observed with an attempt to achieve some "optimum interview technique" and to secure impressions from these farmers on the data collection process.

The 161 observed interviews were obtained from an allocation of observers to interviewers in a manner designed to allow inferences about the entire June Enumerative Survey in North Carolina. Analyses of the data are not complete, but tabulations to date of indices show a pattern in utterance profiles of different types of respondents. Tabulation of enumerator differences are only beginning but suggest that there are differences among enumerators with respect to the enumerator-respondent utterance ratio. Enumerator differences are not subject to conclusive test from present data since the design allows some confounding of differences among enumerators with observers and with geographically associated effects.

The ten re-interviews were of a focused type with purpose of survey, respondent selection and re-enumeration as topics. Judging from these interviews, the involvement of the respondent does not appear to depend on his seeing immediate benefit to himself.

Further tabulation of enumerator differences are in process with an attempt to remove some of the observer and geographic effects. The observation technique will be continued in December on a special sample of respondents to the June Survey. Several techniques of data collection will also be used in an attempt to develop and test indices of deviation resulting from these techniques when compared with the observed interview. (ES/A-18)

2. Survey procedures in the Western States. The delineation of strata according to broad classes of land use has been completed for a number of the Western States and the assembly of these materials into a sampling frame is in progress. The objective is to increase the efficiency of an area sample in this region by controlling sample allocation according to land use. The strata and sub-strata delineated are metropolitan areas; rural non-open country (small towns); irrigated land; non-irrigated cultivated land; privately-owned grazing land and grazing land under the jurisdiction of Bureau of Land Management; land grazed under allotments from these government agencies; land not being grazed but which is not identified as non-agricultural land; and land having neither agricultural activity of any kind nor residences of farm operators. States in which these materials have been virtually completed are Montana, Wyoming, New Mexico, Arizona, Utah, Idaho, Nevada, California and Oregon, and they are nearing completion in

Colorado and Washington. The assembly of these materials into a sampling frame consists of placing the strata and sub-strata on county maps, measuring the area of each block of land constituting each stratum, and recording this information by stratum and county on summary sheets. (ES/A-6, Rev.)

3. Probability mailing list. Work on this project was initiated in 1961, with the screening of segments of land associated with those enumerated during the June Enumerative Survey for farm operators residing inside the segments. This was done in two States: Iowa and Alabama. The lists developed by this process were probability samples of the farm operators residing in these two States. These lists contained the names and addresses of 1,667 farm operators in Alabama and of 1,656 such operators in Iowa. Three mailed surveys were conducted in each State using these lists. The first survey used the September 1 general crop report schedule, the second used the acreage and production card, and the third survey used the December livestock schedule. A sample of 300 non-respondents to each of the three mailed surveys was drawn in each State and the information obtained by interview. For the September farm report, Alabama received 499 usable mailed returns, and successfully interviewed 248 of the 300 selected non-respondents. Iowa received only 308 mailed returns and 278 non-respondent interviews. For the acreage and production survey, Alabama received 516 usable mailed returns, and 245 non-respondent interviews, while Iowa received 443 mailed returns and 281 interviews. Relationships will be examined with a view to developing estimating procedures which reduce the non-response bias to acceptable levels, thereby minimizing the need for non-response interviews. Because of its complexity the analysis is being programmed for the electronic computer and has not been completed. (ES/A-17)

PUBLICATIONS AND PATENTS REPORTING RESULTS OF USDA AND COOPERATIVE RESEARCH

Kelly, Bruce W. April 1962. The research program for crop and livestock estimates, 1961. Statistical Reporter., pp. 45-47.

Line Project Check List -- Reporting Year July 1, 1961 to June 30, 1962

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in	
			Summary of Progress	Area & Sub- Subheading
MD 1-13	Stability of criteria used by homemakers to evaluate fibers in selected items of clothing.	Washington, D.C.	Yes	1-A-1
MD 1-23	Study of the effect of selected factors on food consumption.**	Washington, D.C.	Yes	1-A-12
MD 1-34	Women's attitudes toward cotton and competitive fibers in selected items of clothing.**	Washington, D.C.	Yes	1-A-2
MD 1-38	Outerwear apparel fabric manufacturers' attitudes and opinions toward the blending of wool with synthetic fibers.	Washington, D.C.	No	
MD 1-41	High school children's food habits and attitudes, and their opinions related to the national school lunch program.	Washington, D.C.	Yes	1-A-13
MD 1-43	Consumer discrimination and preference for color added versus natural color oranges.**	Washington, D.C.	Yes	1-A-5
MD 1-44	Consumer discrimination and preference for frozen french-fried potatoes in packages containing varying amounts of slivers, small and irregular pieces.**	Washington, D.C.	Yes	1-B-1
MD 1-45	An appraisal of the market possibilities for superconcentrated apple juice through a consumer survey.	Washington, D.C.	Yes	1-A-9
MD 1-46	An evaluation of the market possibilities of a canned wheat bulgur through a consumer survey.	Washington, D.C.	Yes	1-A-7
MD 1-47	Young people's use and appraisals of natural and competing fibers used in wearing apparel.	Washington, D.C.	Yes	1-A-4
MD 1-48	Study of attitudes toward pilot food stamp operations.	Washington, D.C.	Yes	1-A-14
MD 1-49	Fabric and fiber patterns of use and preferences among automobile manufacturers.	Washington, D.C.	Yes	1-A-3
MD 1-50	Study of the effect of selected characteristics of fresh citrus fruit on trade and consumer acceptance.*	Washington, D.C.	Yes	1-B-2
MD 1-51	Consumer acceptance of sweetpotato flakes.*	Washington, D.C.	Yes	1-A-8
MD 1-52	Consumer preferences, usages, and buying practices for noncitrus fruits.*	Washington, D.C.	Yes	1-A-10
S&R-O- O-1(DOD)	Homemaker's estimates of food on hand.*	Washington, D.C.	Yes	1-A-15
ES/A-2, (Rev.)	Studies on the relationship of early-season plant observations made on corn and sorghum to final yield.	Ames, Iowa	Yes	2-A-1
ES/A-5, (Rev.)	Development of improved sample survey procedures for crop and livestock estimates in certain North Central and Southern States.	Wash., D.C. & State offices of Va., Mich., Minn. Mo., Nebr., Ohio, S.Dak., Wis.	No	
ES/A-6, (Rev.)	Development of improved sample survey procedures for crop and livestock estimates in Western States.	Wash., D.C. & State offices of Ariz., Calif., Colo., Idaho, Mont., Nev., N.Mex., Ore., Utah, Wash., Wyo.	Yes	2-B-2
ES/A-9, (Rev.)	Development of improved forecasts and estimates of corn yields and the development of procedures for forecasting corn quality in 7 North Central States and Virginia.	Wash., D.C., & State offices of Mich., Minn., Mo. Nebr., Ohio, S.Dak., Wis., Va.	Yes	2-A-2
ES/A-10, (Rev.)	Development of improved forecasts and estimates of winter wheat yields.	Wash., D.C. & State offices of Tex., Okla., Ill., Ind., Kan. Mich., Mo., Nebr. Ohio, Colo., Mont.	Yes	2-A-3

* Initiated during reporting year.

** Discontinued during reporting year.

Line Project Check List -- Reporting Year July 1, 1961 to June 30, 1962

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in	
			Summary of Progress	Area & Sub- Subheading
ES/A-11, (Rev.)	Development of improved forecasts and estimates of soybean yields in the selected States.	Wash., D.C. & State offices of Ill., Ind., Iowa Kan., Mich., Minn., Mo., Nebr Ohio, S.Dak., Wis., Ark.	Yes	2-A-4
ES/A-12	Development of an improved sampling and data collection procedure for estimating prices received and prices paid by farmers.	Wash., D.C. & State office in Ohio.	No	
ES/A-14, (Rev.)	Improvement of yield forecasts on sour cherries and apples through objective fruit counts and measurements.	Wash., D.C. & State offices of Mich., N.Y., Penn., Wis.	Yes	2-A-5
ES/A-16	Development of improved forecasts for the yield of irrigated cotton.	Wash., D.C. & State offices of N.Mex., Ariz., Calif.	Yes	2-A-6
ES/A-17	Probability mailing list from screened segments.	Wash., D.C. & State offices of Ala., Iowa.	Yes	2-B-3
ES/A-18	Study of the farm operator as a supplier of agricultural statistics.	Raleigh, N. C.	Yes	2-B-1

